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What memory binding functions is the hippocampus responsible for?

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Abstract

The role of the hippocampus in binding information in working memory (WM) is little understood. When complex experiences comprise associations between different pieces of information such as objects and locations (relational binding), the function of the hippocampus is required to hold them in WM (Mitchell et al., 2000; 2006; Piekema, 2006). However, recent evidence suggests that if the to-be-associated information leads to the formation of integrated objects such as coloured shapes (conjunctive binding), the hippocampus is less involved in holding temporary representations of these complex events in WM (Baddeley et al., 2010; Piekema, 2006). We investigated the relational and conjunctive binding hypotheses of the hippocampal functions in a patient with right hippocampal damage. The patient and controls were asked to study visual arrays of stimuli which consisted of shape-colour relations (shape-colour pairs) or shape-colour conjunctions (coloured shapes). After the study array, they were presented with a new screen consisting of one set of shapes (line drawings) and one set of colours. They were asked to reconstruct the bindings by selecting the shapes and their corresponding colours. As compared to healthy controls, the patient was impaired in holding relations of shapes and colours in WM whereas he could retain the conjunctions similarly to controls. These results lend support to the role of the hippocampus in supporting memory for inter-item associations but not memory for conjunctions of features which define objects' identity.